



**Universiteit  
Leiden**  
The Netherlands

**Serial learners: interactions between Funnel Beaker West and Corded Ware communities in the Netherlands during the third millennium BCE from the perspective of ceramic technology**

Kroon, E.J.

**Citation**

Kroon, E. J. (2024, September 18). *Serial learners: interactions between Funnel Beaker West and Corded Ware communities in the Netherlands during the third millennium BCE from the perspective of ceramic technology*. Sidestone Press, Leiden. Retrieved from <https://hdl.handle.net/1887/4092578>

Version: Publisher's Version

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Downloaded from: <https://hdl.handle.net/1887/4092578>

**Note:** To cite this publication please use the final published version (if applicable).

## Beakers, Plagues, and Battle Axes

5000 years ago, a migration shaped Europe's future. Migrating communities from the Eurasian steppe spread from Russia to the Rhine in a little over a century, leading to lasting changes in genetics, language, and connectivity. Archaeologists recognised this migration as early as the nineteenth century as the widespread appearance of S-shaped, cord decorated ceramics (Kloppfleisch 1883; see Fig. 1.1). Hence the name of this entity: Corded Ware.

Corded Ware did not appear in an empty continent. These migrating communities encountered the descendants of hunter-gatherers and early farmers, societies with



Figure 1.1: Typical Corded Ware vessels from Denmark (left; CC BY-SA, Roberto Fortuna & Kira Ursem, The National Museum of Denmark) and the Netherlands (right; Source: Rijksmuseum van Oudheden, Leiden). These vessels feature a uniform style despite the intervening distance. Both vessels are S-shaped with the eponymous cord impressions on the upper body and a row of elongated impressions just above the shoulder. These ceramics first led archaeologists to argue for a migration event and continue to inform such arguments as geneticists rely on ceramics to situate human skeletal remains in historical contexts.

millennia-old roots in Europe. Yet, the migrants had an outsize impact on European history. What interactions between migrating and indigenous groups led to this outcome? I argue here those typical ceramics can shed new light on this issue.

## 1.1 A Very Short Introduction to the Third Millennium BCE

This section is an introduction to the two major themes in the current debate on the third millennium BCE in Northwest Europe: culture change and migration. The introduction is far from exhaustive but highlights crucial studies and issues. The interpretations of the third millennium BCE discussed in the next section all revolve around these themes.

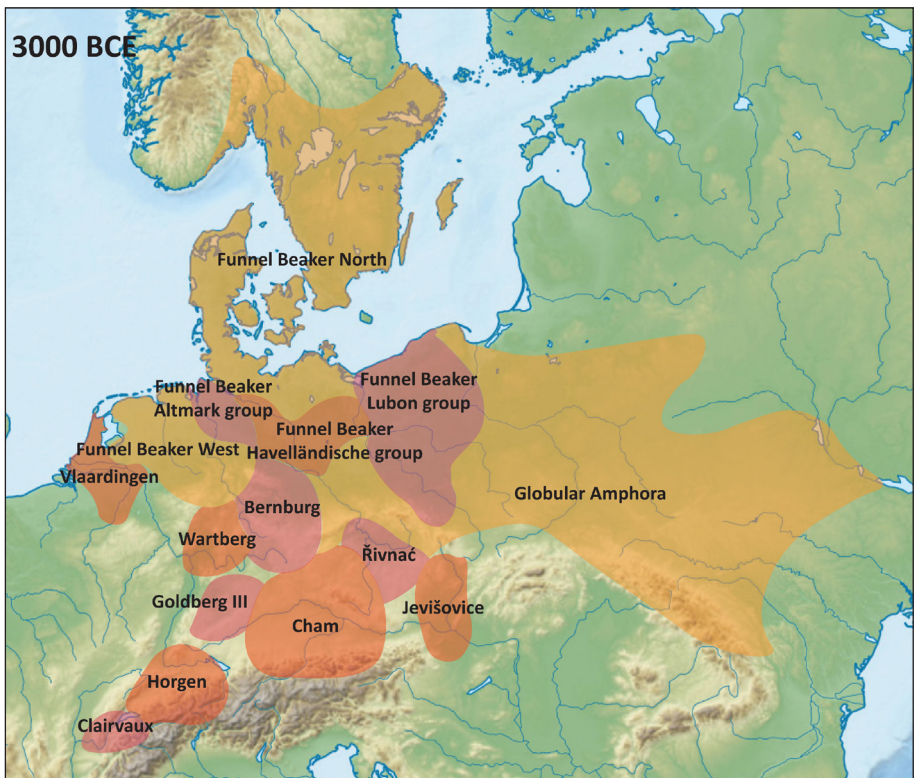
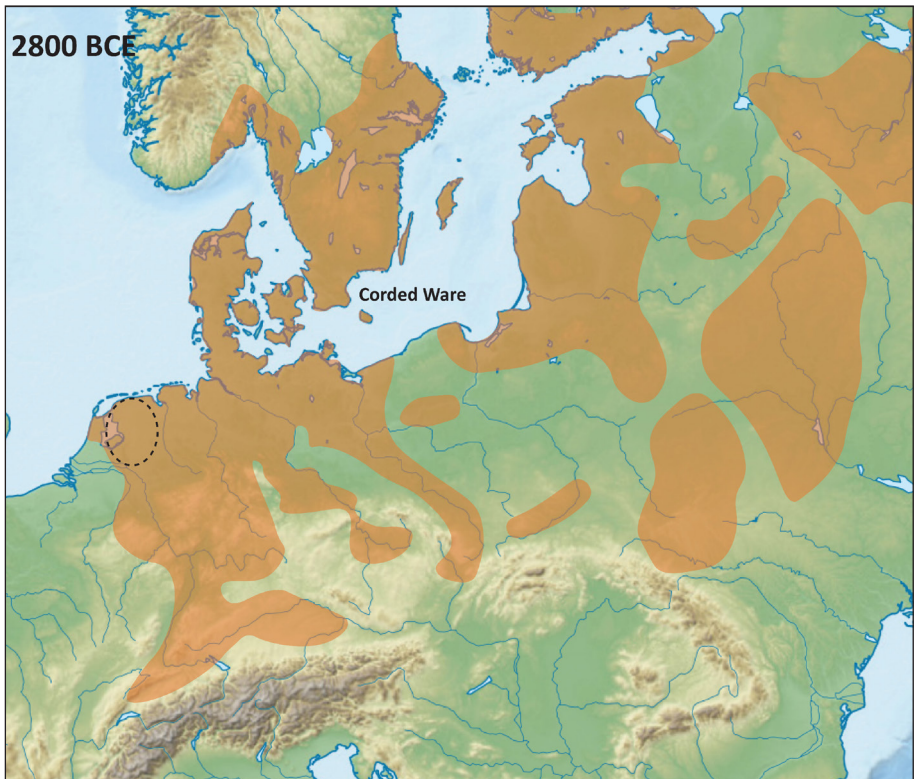
The third millennium BCE was a period of change in Europe. The protagonist in these changes is an entity referred to as Corded Ware. The defining traits of Corded Ware are similarities in ceramics (see Fig. 1.1) and funerary rituals (cf. Bourgeois and Kroon 2017; Furholt 2014a). These two elements spread rapidly across Europe between 3050-2900 BCE (Heyd 2021 p. 393). Their spread is also seen as the end of older, regional entities, such as Funnel Beaker, which are defined by their own typical ceramics and funerary practices, and have roots in the fourth millennium BCE (cf. Furholt 2014a; see Fig. 1.2).

The problem is that the meaning of these similarities in funerary rituals and ceramics (and the changes therein) is unclear (Roberts and Vander Linden 2011; Sørensen 2015). Archaeologists tend to approach these similarities through a culture-historical perspective, which envisions these entities as cultural phenomena or groups with particular historical trajectories (cf. Rebay-Salisbury 2011; Trigger 2006 pp. 240; 311–3). Crucially, this perspective structures (*sensu* White 2014) these entities, and all evidence relating to them, along a narrative of emergence, rise, decline, and fall. The past essentially becomes a continuous cycle: the emergence and rise of Corded Ware follow the decline and fall of Funnel Beaker, the decline and fall of Corded Ware give rise to Bell Beaker, and so forth.

Migration played a crucial role in these cycles. Given that each group or phenomenon has characteristic funerary rites and ceramics, disruptive migration events served to account for changes in these traditions (cf. Cabana and Clark 2011 pp. 3–4; Cameron 2013 p. 220; Hakenbeck 2008 p. 13). A key point for upcoming sections is that this culture-historical perspective was rejected but not abandoned in (post-)modernity, which has impeded further thinking about the nature of migration and similarity (Anthony 1990; Burmeister 2000; Sørensen 2015). Consequently, reiteration of this narrative structure continues to colour interpretations of the third millennium BCE (see Section 1.2) and is a key background factor in the debate about this period.

Ancient DNA (aDNA) analysis has re-ignited debates on the role of migration in explaining the above-mentioned similarities. Analyses show humans buried with Corded Ware ceramics differ in ancestry from older Neolithic populations. These individuals have so-called steppe ancestry, indicating they descend from populations thought to inhabit the Eurasian steppe before the third millennium BCE. By contrast, the genomes of individuals associated with older archaeological cultures in Europe typically do not feature steppe ancestry but a mixture of genetic profiles associated with early farmer,

Figure 1.2 (opposite page): The culture-historical view of the first half of the third millennium BCE in Northwest Europe (after: Von Schnurbein and Hänsel 2009). The emergence of Corded Ware leads to the disappearance of a patchwork of regional archaeological cultures between 3050-2900 BCE. The figure above shows the study area encircled with a dotted line.



and various hunter-gatherer populations (Allentoft *et al.* 2015; Damgaard *et al.* 2018; Haak *et al.* 2015; Mathieson *et al.* 2015, 2018; Mittnik *et al.* 2017, 2018; Olalde *et al.* 2018; Papac *et al.* 2021). Therefore, this change in ancestry indicates a migration of people with steppe ancestry into Europe.

There are many additional findings about this period which are relevant to the debate. Most notably on possible plague outbreaks (cf. Andrades Valtueña *et al.* 2022; Susat *et al.* 2021 for a critique), male sex bias in migrating communities (Goldberg *et al.* 2017; cf. Lazaridis and Reich 2017; Scorrano *et al.* 2021; Frieman and Hofmann 2019), and personal mobility and kinship structures (Sjögren *et al.* 2016; cf. Brück and Frieman 2021; Linderholm *et al.* 2020; Mittnik *et al.* 2019; Monroy Kuhn *et al.* 2018). A full discussion of these findings is beyond the scope of this dissertation, but they do inform various interpretations of the changes in archaeological culture and ancestry in the third millennium BCE (see below).

The migration event during the third millennium BCE leads to three historic changes in Europe. Firstly, the admixture of steppe ancestry gives rise to the genomic diversity seen in all European populations and may have introduced traits such as lactose tolerance in these populations (Haak *et al.* 2015; Lazaridis *et al.* 2014). In addition, this migration event is probably associated with the introduction of Indo-European languages, spoken today throughout Europe and the world (Iversen and Kroonen 2017; cf. Heggarty 2018). Lastly, the interconnectedness of Corded Ware communities during and after the migration event (Bourgeois and Kroon 2017, 2023) facilitated the spread of metallurgy and the onset of the Bronze Age (Kristiansen and Larsson 2005). This combination of changes in material culture, ancestry, language, and connectivity points towards the fundamental impact of this migration event.

The outcomes of aDNA analysis have put migration back at the forefront of archaeological debates about the third millennium BCE. Yet, migration in itself does not necessarily result in the discontinuity of indigenous groups in terms of language, ancestry, or material culture (Furholt 2017a; Heyd 2017; Vander Linden 2016). Therefore, the key question in the debate about the third millennium BCE is: what interactions between migrating and indigenous groups drove these changes?

The above question is the central question in this dissertation. However, there is a second problem which needs to be addressed to answer this question. This problem is the continued reliance on the culture-historical perspective and concepts for understanding the large-scale developments during the third millennium BCE (see above). A brief discussion of three seminal explanations for the developments during the third millennium BCE illustrates this problem. Sections 1.3 and 1.4 are an outline of a new perspective on ceramics which moves beyond this issue.

## 1.2 Three Answers, One Problem

Since the initial aDNA studies of the third millennium BCE (Allentoft *et al.* 2015; Haak *et al.* 2015), three seminal, explanatory accounts of the large-scale developments in the third millennium BCE have emerged in archaeology. All of these models identify the same central concern: how does the spread of genetic information relate to the spread of cultural information? The discussion below looks at the connections between genetic and cultural information proposed in these models. My criticism of these connections is crucial for the perspective on ceramics outlined in Sections 1.3 and 1.4.

The oldest explanatory account stems from Kristiansen *et al.* (2017; Kristiansen 2022). This publication ties together a broad range of studies in a provocative account (cf. Frieman *et al.* 2019; Furholt 2021). Kristiansen *et al.* (2017) suggest older Neolithic societies collapsed due to a plague outbreak (cf. Rasmussen *et al.* 2015), followed by a migration of, predominantly, men from the Eurasian steppe who spoke Indo-European languages (cf. Anthony and Brown 2017; Iversen and Kroonen 2017). These men leveraged an advantage in mobility and weapons to take wives from the indigenous groups, and these wives then fashioned ceramics after the basketry of their new husbands, resulting in Corded Ware styled ceramics (Kristiansen *et al.* 2017 p. 342). The overall scenario closely resembles Diamond's (1997) *Guns, Germs and Steel* (hence the chapter title).

The second explanatory account stems from Furholt (2021) and is born out of a critique of Kristiansen *et al.* (2017). Furholt bases his account on modern migration theory, specifically the concept of translocality (cf. Furholt 2017b). He argues the third millennium BCE saw a general increase in mobility (cf. Sjögren *et al.* 2016; Wentink 2020) with migrating groups acting as a go-between among various indigenous groups. This increased connectivity led to the adaptation of a single standard (i.e. Corded Ware) in pottery production and burial ritual among various communities (cf. Booth *et al.* 2021). The adoption of this new style would also have led to the decline of the signature material culture and funerary practices of various indigenous groups.

The third explanatory account is from Heyd (2021) and is well-sourced for Central and East Europe. This account uses the same elements as that of Kristiansen *et al.* (2017) but places more emphasis on migration as a driving mechanism for change. Heyd (2021 pp. 404–5) suggests migrating communities with a specific ceramic style and funerary ritual settled in Northwest Europe and disrupted indigenous communities, contrary to Central and East Europe, where he argues more continuity and mixing of populations took place (ibid. p. 387). He suggests famines, plagues, and violence may have played a role in the lack of resistance from indigenous communities (cf. Kristiansen *et al.* 2017).

The above three explanations all provide different mechanisms for the spread of Corded Ware and the interactions between migrating and indigenous communities. These mechanisms tie the spread of genetic information (steppe ancestry) to the spread of cultural practices (i.e. Corded Ware ceramics and funerary rites). The shared problem is that they draw a connection from similarities in ceramics to genetics via past groups to do so. This connection re-introduces the issues surrounding cultural history.

The connection between genetics and ceramics results from the contextualisation of genetic samples. A genetic sample from human remains becomes 'Corded Ware' if the burial contains Corded Ware pottery (e.g. Olalde *et al.* 2018 Supplementary Information 2; see Fig. 1.1). Various archaeologists point out that interpreting this connection as an indicator for groups is problematic (Frieman and Hofmann 2019; Furholt 2017a; Heyd 2017; Vander Linden 2016), but to my mind the problem lies with archaeology, not genetics. Geneticists use these labels because archaeologists continue to reiterate the cultural histories in which entities such as Corded Ware are protagonists (cf. Booth 2019; Eisenmann *et al.* 2018).

This reiteration of cultural history is also apparent from the connection between ceramics, migration, and genetics in Kristiansen *et al.* (2017), Furholt (2021), and Heyd (2021). All three models treat similarity in ceramics as a sign of group membership. Kristiansen *et al.* (2017) depict ceramic style as an indicator of the integration of women from one group into another. Furholt (2021) argues the spread of this style is the coalescence

of multiple groups within an interaction network. Lastly, Heyd (2021) considers ceramic style as a typical habit for a group. In addition, all three models also follow the culture-historical narrative for this period: the rise of Corded Ware equals the fall of indigenous groups with migration, through one mechanism or another, as the driver of this process.

Not only do these relations between migration, genetics, and ceramics contradict earlier criticism of culture-historical approaches (see above), they also clash with studies about the long-term integration of migrants in host societies from migration studies (Castles *et al.* 2014; De Haas 2023), as well as archaeological (e.g. Iversen 2020; see Section 2.5) and genetic evidence for the survival of indigenous groups (cf. Haak *et al.* 2015 on the resurgence of hunter-gatherer and early farmer genetic profiles).

However, the foremost problem for these models is that neither genetics nor ceramics necessarily relate to groups. Ceramics are not similar because people belong to the same group, or have the same genes. Ceramics are similar because potters learned, and chose, to do the same thing (cf. Sørensen 2015) and these choices and learning processes may or may not relate to groups (e.g. Gosselain 2008a p. 169; Roux *et al.* 2017; see Section 3.1).

These problems go to show how much archaeological thinking about large-scale developments still relies on the culture-historical perspective (see Section 1.1). Consequently, the methodological challenge in understanding the spread of genetic and cultural information during third millennium BCE is to move beyond this perspective. In this dissertation, I address this challenge by developing a new approach to ceramics. This approach does not consider ceramics as the typical product of past groups but as the product of transmitted technical knowledge. An outline of this approach is presented below after a brief discussion on migration.

### 1.3 Migration: A Link Between Scales

Migration has a long history of being conflated with (abrupt) one-way relocation of groups in archaeology. This conflation goes back to the culture-historical view of the past as a sequence of groups with characteristic traditions (Hakenbeck 2008 p. 13; see Section 1.1). Therefore, two qualifications about the use of the term migration in this study are necessary.

Firstly, the definition of migration used here stems from De Haas (2023 p. ix) who states that migration is a form of geographic mobility which leads to a prolonged (min. 6-12 months) change in area of habitual residence. This change of residence is often temporary and reversible (cf. Anthony 1990 p. 904; Cabana and Clark 2011 p. 5). This definition may appear too focussed on micro-scale processes for prehistoric archaeology (see below) but in fact isotope analyses have already demonstrated the existence of such complex, micro-scale migrations in the third millennium BCE (e.g. Haak *et al.* 2008; Knipper *et al.* 2017; Sjögren *et al.* 2016; see also Booth *et al.* 2021). The value of aDNA analysis and specifically isotope analysis should then be clear in light of this definition. These methods provide direct empirical evidence for migration of individuals, bypassing the need for detecting migration on the basis of material culture (cf. Anthony 2023; Burmeister 2016 pp. 44; 50, 2017 p. 63; Kristiansen 2014). Interpreting the impact and role of such migrations however remains a matter for archaeologists (cf. Burmeister 2017 p. 65).

The second qualification is that archaeological investigations of migration operate at macro-scale out of necessity. The resolution of the archaeological record does not allow us to systematically discern the journeys, experiences, and motivations of individual migrants or hosts which are crucial for modern migration studies (Anthony 1990;

Tsuda *et al.* 2015). However, investigating migration at macro-level does not imply archaeologists should return to studying groups of people migrating over larger distances (*contra* Burmeister 2000; McSparron *et al.* 2020; Tsuda *et al.* 2015 p. 19). This is especially clear in light of the above-mentioned isotopic evidence that migration during the third millennium BCE was as complex, varied, and dynamic at micro-level as present-day and historic migrations (cf. Cameron 2013; Castles *et al.* 2014; De Haas 2023). Therefore, an archaeological perspective on migration should look at macro-scale patterns visible in the archaeological record while accepting and accommodating for complex individual behaviour at micro-scale.

As such, the perspective on migration (and technical knowledge of potters; see below) taken here revolves around aggregate effects. These are general patterns which emerge when we view the complex and varied behaviours of many individual agents as a whole (*sensu* Durkheim 2002). For example, the labels ‘migrating groups’ and ‘indigenous groups’ are used here not to indicate that every individual in this group was a migrant (or not), but that on the whole members of this group arrived in Europe relatively recently at the start of the third millennium BCE (migrating), or had been in Europe for longer at that time (indigenous). These terms refer to macro-scale patterns visible in the aggregated micro-scale behaviours of many individuals over centuries (qualification 2), but remain agnostic about their individual behaviours and life histories without reducing them to groups (qualification 1). The focus on aggregate effects enables a macro-level understanding of the past which acknowledges the complexity and intricacy of human behaviour at micro-scale.

The goal of this dissertation then is not to detect migration or assess the lives of individual migrants, hosts, and potters. It is to understand and interpret the patterns which emerge from countless such lives and migrations. The same perspective also shapes the approach to learning and ceramic technology outlined below.

## 1.4 Thinking with Ceramics

Ceramics will remain a vital source of information for archaeology. Ceramics survive better than other material categories and are abundant in the archaeological record from the moment of their appearance (cf. Jordan and Zvelebil 2009). Moreover, ceramics mattered. The far-flung appearance of similar vessels indicates people in the past attached value to their production (cf. Sørensen 2015; see above). The question is: what kind of information do we extract from ceramics?

Archaeological studies of ceramics often exhibit a narrow focus on the visual aspects of these artefacts: decoration and shape, taken together as style (see above). Instead, the focus here is on the *chaîne opératoire* of ceramics. A *chaîne opératoire* consists of an ordered sequence of techniques (i.e. efficacious gestures with(out) a tool on matter) which went into the production of a vessel. This sequence can be reconstructed from traces on a vessel (cf. Roux 2019a). Contrary to ceramic style, which may simply be copied, production techniques are taught, embodied knowledge (cf. Gosselain 2018; Roux 2019a). Therefore, the *chaîne opératoire* approach enables the reconstruction of learning in the deep past.

There are several other studies which look at ceramic *chaînes opératoires* to understand the developments in the third millennium BCE (for recent examples: Derenne *et al.* 2020, 2022; Kroon *et al.* 2019; for older examples: Hulthén 1977; Van der Leeuw 1976). The approach below departs from these studies by focusing on variability over time, rather than identifying a particular technical practice with a particular group.

## Why Variability over Time? And How?

As stated, the techniques and their ordering in a *chaîne opératoire* are learned, technical knowledge. This learned nature itself implies variability. Ethnographic studies show potters generally know multiple, alternate (orders of) techniques to produce ceramics (e.g. Gosselain 2008a p. 169). This is because they continuously acquire such knowledge throughout their lives via direct and indirect interactions with other potters, including potters who live across social boundaries (Gosselain 2017, 2018). Therefore, the knowledge of potters must be seen as a changing technical repertoire which allows for many alternative *chaînes opératoires*. Each singular *chaîne opératoire* is but one actualisation of the variation possible within a technical repertoire when the ceramic vessel is made (see Ch. 3).

In practice, this means we must look at many different *chaînes opératoires* to build up an image of technical knowledge. This goes especially for archaeology because the archaeological record does not allow us to consistently discern individual technical repertoires. Moreover, we must accept that a difference in production techniques might merely be an alternative choice within the same technical repertoire. As such, the core question is when such differences are significant.

The approach to ceramic technology developed here incorporates these two notions. The units of analysis are large groups of vessels, referred to as bodies of knowledge, which represent the variability in ceramic production among migrating and indigenous groups during the third millennium BCE (see Section 1.3 on aggregate effects). Moreover, I develop a new, probabilistic comparison for *chaînes opératoires* to compare these bodies of knowledge (see Ch. 4). Put simply, this comparison calculates a distance between two groups of *chaînes opératoires* by looking at the number of new, or different (combinations of) techniques which appear in one group of *chaînes opératoires* relative to the other. The more of these changes, the greater the distance. Consequently, the distance is an indicator of the amount of new technical knowledge that indigenous potters would need to learn to produce Corded Ware vessels. If this distance is small or becomes smaller over time, this suggests knowledge transmission between migrating and indigenous potters. A large distance on the other hand indicates such knowledge transmission is unlikely. A comparison against a control group of unrelated *chaînes opératoires* serves to assess the significance of these distances: if the distance between the *chaînes opératoires* of indigenous and migrating groups is smaller than that to the unrelated control group, this points towards sharing of knowledge (and vice versa).

The probabilistic comparison enables a test of the scenarios which have been proposed for the impact of migrations during the third millennium BCE. For example, Kristiansen *et al.* (2017) propose that the same potters who produced the ceramics associated with indigenous groups also produce Corded Ware ceramics. Therefore, a comparison of bodies of knowledge for indigenous groups and Corded Ware should result in a distance which is much shorter than the distance to the control group. After all, the same technical repertoires produce both groups of *chaînes opératoires*.

The power of the probabilistic approach is the ability to detect this development, and potentially many others, in the transmission of knowledge from ceramics. By treating this as a probabilistic problem, we allow for the possibility past potters learned particular techniques and production methods. This also means ignoring the *a priori* classification of people by pottery style. Making Corded Ware pottery is something one can learn, today and in the past. Ultimately, the approach outlined here is not about people, but about the

knowledge transmission in which people figure. Therefore, this approach goes beyond culture-historical perspectives and offers a new perspective on the third millennium BCE.

There is one final point about learning ceramic technology before we move on to the research question and broader relevance of this study. Throughout this dissertation, prehistoric potters are not identified as either men or women. It is commonplace in prehistoric archaeology to envision potters as women working in household contexts (e.g. Holmqvist *et al.* 2018; Larsson 2009 p. 410). This connection between women and ceramic technology can even form the link between changes in material culture and genetics (cf. Kristiansen *et al.* 2017 pp. 340; 342). However, there is no direct evidence for this assumption. Instead, it is a sweeping generalisation based on old anthropological studies (Frieman *et al.* 2019 pp. 158–9), which themselves are often more nuanced (cf. Murdock and Provost 1973 Tab. 4). New methods may soon remedy the lack of direct evidence for the sex of prehistoric potters (cf. Fowler *et al.* 2019, 2020, but see Bécue and Champod 2023; Sharma *et al.* 2021) but until such time we should remain open-minded about who past potters were.

### 1.5 Research Question and Study Area

The sections above discuss the pivotal problem in archaeological, genetic, and linguistic studies of the third millennium BCE, and the potential of a new approach to ceramic technology to unravel this problem. This leads to the following research question:

*What can be inferred from developments in ceramic technology about the nature of the interaction between migrating and indigenous communities that shaped the Corded Ware transition?*

This question is applied here to the interaction between indigenous Funnel Beaker West, and migrating Corded Ware communities in the Netherlands (see Fig. 1.2). There are three reasons to select the Netherlands as the study area.

Firstly, ever since the arguments of Glasbergen and Van der Waals (1955; cf. Beckerman 2012; Fokkens 2012), the Dutch archaeological record has played a prominent role in debates about the third millennium BCE (cf. Olalde *et al.* 2018 for a recent example). Moreover, the transition from Funnel Beaker West to Corded Ware in the Netherlands is thought to be a rapid, disruptive process (cf. Lanting and Van der Plicht 2000). This interpretation informs ideas about massive migrations as proposed by Heyd (2021), and Kristiansen *et al.* (2017). Therefore, studies of the Dutch archaeological record are of importance for the debate about the third millennium BCE as a whole.

Secondly, systematic studies of Funnel Beaker West and Corded Ware sites go back more than a century in the Netherlands (Bakker 1992, 2010; Fokkens 2005 pp. 364–6) and continue to date (cf. Beckerman 2015; Fokkens *et al.* 2016; Wentink 2020). As such, there is a rich archaeological dataset available for study. This is crucial for attempts to capture the variation in Funnel Beaker West and Corded Ware ceramic technology.

Lastly, Funnel Beaker West and Corded Ware sites in the Netherlands are located in areas with poor preservation of organic remains (cf. Fokkens 2012), leading to relatively poor sample density in aDNA studies (cf. Olalde *et al.* 2018). Therefore, there is all the more urgency to developing an approach which harnesses inorganic materials such as ceramics for understanding the major issues in prehistory.

## 1.6 The Third Millennium BCE: A Matter of Concern

Studying the migration event during the third millennium BCE takes on additional urgency in light of popular outreach about this event. Popular accounts often stress a violent, disruptive interpretation of the migration event. More nuanced stances appear as an afterthought (e.g. Barras 2019; Callaway 2017; McKie 2017). These publications contribute to a popular image of migration as erosive to society, fuelling political extremism during the ongoing migration crisis (cf. Hakenbeck 2019).

The problem is that such depictions themselves draw upon a few, one-sided narratives about historical migration events. Notably, the ideas of Diamond (1997) about the colonisation of the Americas, and Heather (2009) about the Migration Period. More nuanced stances on historical migrations (e.g. Geary 2002; Halsall 2013; Oosterhuizen 2019 for the Migration Period) are absent in the debate. The same applies to the depiction of Corded Ware and Yamnaya as highly mobile, warlike nomads. This image leans into stereotypes about nomads but ignores more nuanced studies of nomadism (cf. Chang 2018; Hämäläinen 2008; Khazanov 1994; Spengler *et al.* 2021).

The risk then is that archaeology becomes part of a circular argument. The narratives about the third millennium BCE feed into and normalise certain views on contemporary and historical migrations. In turn, these views feed back into archaeological conceptualisations of migration. This circular argument is already underway: in a recent publication about nomadic empires on the Eurasian steppe, Hoppenbrouwers (2023 Chapter 1) places Corded Ware and Yamnaya on equal footing with the empires of Atilla the Hun and Dzhengis Khan. The only way to break this circular argument is a detailed investigation of migration processes on the ground during the third millennium BCE. Archaeology should not touch up cases with (tacit) parallels to history and anthropology when studying migration but should seek new perspectives and tools which play into its strengths. I hope that the perspective on ceramic technology and migration outlined here contributes both to our knowledge about the third millennium BCE and the search for such a perspective.

## 1.7 Outlook

This dissertation has three parts. The first part contains background information and the theoretical fundamentals of this study. This part encompasses Chapters 2, 3, and 4. Chapter 2 is a critical examination of our knowledge about Funnel Beaker West and Corded Ware in the Netherlands. The core point in Chapter 3 is that we should not study this period by drawing associations between technical traditions and past groups, but by looking at the long-term variability in ceramic technology which results from learning. Chapter 4 is an outline of the probabilistic method to compare *chaînes opératoires* which can take this variability into account.

The second part of the study includes Chapters 5 to 8. The focus of this part is ceramic technology in Funnel Beaker West and Corded Ware. Chapter 5 is a discussion of the sampling strategy and analytical tools applied to reconstruct *chaînes opératoires*. The analytical methods are macroscopy and ceramic petrography. The outcomes of the macroscopic analysis of Funnel Beaker West and Corded Ware ceramics are reported in Chapters 6 and 7 respectively, whereas the outcomes of the petrographic analyses are presented in Chapter 8.

Lastly, Chapters 9 to 14 form the final, synthetic part of this study. Chapters 9 and 10 are comparisons of the results from Chapters 6 to 8 with the standard, abductive method

and the new probabilistic method from Chapter 4, respectively. The comparisons yield complementary results and shed new light on the transition between Funnel Beaker West and Corded Ware. The discussions in Chapters 11, 12, and 13 tie these findings back into broader debates about Neolithic ceramic technology, indigenous groups, and migrating groups in the third millennium BCE. Lastly, Chapter 14 contains the answer to the research question and a summary of the key findings of the study.

